

MiniScope Control 6.51 Instruction Manual



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1. TECHNICAL DATA	3
2. EXTENT OF DELIVERY	3
3. INSTALLATION	4
3.1. Installation of the device	4
3.2. Installation of the software	4
3.3. Deinstallation of the software	4
4. STARTING THE SPECTROMETER.....	5
5. MINISCOPE CONTROL.....	5
5.1. Contents of the window	5
5.2. Parameters.....	6
5.2.1. Magnetic field	6
5.2.2. Sweep time	6
5.2.3. Modulation amplitude	6
5.2.4. Microwave power.....	6
5.2.5. Gain	6
5.2.6. Phase	7
5.2.7. Smooth.....	7
5.2.8. Steps.....	7
5.2.9. Accumulations	7
5.3. Parameter adjustment	7
5.4. Indicators.....	7
5.5. Tuning of the microwave bridge	8
5.5.1. Automatic Tuning	8
5.5.2. Manual Tuning.....	9
5.6. Recording spectra	10
5.7. Menus	10
5.7.1. File	10
5.7.1.1. New	10
5.7.1.2. Open	10
5.7.1.3. Save	10
5.7.1.4. Save As.....	10
5.7.2. View	11
5.7.2.1. Spectrum line params.....	11
5.7.2.2. Stretch vertically	11
5.7.2.3. Cancel v. stretch.....	11
5.7.2.4. Shrink to window	11
5.7.2.5. Status Bar	11
5.7.3. Batch.....	12
5.8. Cursor	12

1. Technical Data

Case	53*35*42 cm /60 kg	
Power Consumption	ca. 500 VA	
Microwave (MW) Power	100 μ W-50 mW (10 μ W-100 mW optional)	1*
Sensitivity	MS300: $8 \cdot 10^9$ Spins/G / MS100: $2 \cdot 10^{10}$ Spins/G	
MW Frequency	9,30-9,55 GHz	
Field Homogeneity	\pm 50 mG sample area	
Field Range	500 - 4500 G (optional 500 – 6000 G with water cooling)	1*
Field Sweep	0 – 4000 G (optional 0 – 5500 G with water cooling)	
Sweep Time	12 s – 34 min	
Field Stability (short time)	20 mG/min	
Field Modulation	50 mG - 7 G	
Modulation Frequency	100 kHz	
Resonator	rectangular TE102	

1* see notes in chapter 3.1

2. Extent of Delivery

- (1) ESR Spectrometer *MiniScope*
- (2) Power cord
- (3) Serial cable
- (4) Fixation for sample tubes (different sizes)
- (5) Guidance tube F-120/1,5 for the usage of disposable capillary tubes
- (6) Disposable glass capillaries Volume 50 μ l 250 pieces
- (7) Sealing kit for disposable glass capillaries
- (8) Installation CD *MiniScope Control&Treatment (Control software, Analysis, Multiplot)*

3. Installation

3.1. Installation of the device

- (1) Place the device at its assigned place of work.

Please note: The device is sensitive to external magnetic fields. Therefore it should not be placed in the neighbourhood of devices which generate strong magnetic fields themselves.

The closed magnet of the device generates a harmless magnetic field of max. 0.3 mT on the case of the device.

The device generate microwave power of 100mW inside the closed system. The construction of the device block all microwave power outside of the electronic system and the case.


- (2) Connect PC and *MiniScope* using the provided serial cable. Connect the 9 pin plug with the socket at the backside of the *MiniScope* and the other 9 pin plug to the serial port (RS232) of the PC (COM1 or COM2). If no serial port exist, use RS232-to-USB-adaptor.

3.2. Installation of the software

For installing the control software for the ESR spectrometer *MiniScope* put the installation CD *Miniscope Control&Treatment* into the drive. If the option autostart for this drive is set the installation starts automatically. Otherwise you have to start the program SETUP.EXE in the directory *Miniscope_Control_Treatment* on the installation CD. For this you have to execute "Run.." from the Start-menu. Start now "Browse.." and change the path into the directory *Miniscope_Control_Treatment* on the installation CD. Select SETUP.EXE and press "Open". By pressing *OK* the installation will be started.

Select *Minimal* for installing *Miniscope Control 6.51* only. If you want install *Analysis* and *Multiplot* additionally, you have to select *Typical*.

The software for controlling the ESR spectrometer comprises the files *MINISCOPE32.EXE*, *MINISCOPE.INI* and *MINISCOPE32.ICO*. The installation copies these files into the subdirectory "C:\Program Files\EsrApplications\MiniscopeControl". You find a new item in the menu *Start\Programs\EsrApplications* with the name *Miniscope Control 6.51*. In addition

a new icon  for *Miniscope Control 6.51* is placed on desktop.

After installation and before starting the spectrometer for the first time the serial port being used for the connection between PC and *MiniScope* has to be fixed. For that purpose choose the corresponding value for the *EPR_port* in the file *MINISCOPE.INI* using a text editor. If *COM1* is used, the 3rd line has to run "*EPR_port=1*". If the PC shall be connected with the *MiniScope* using *COM2*, the 3rd line has to run "*EPR_port=2*". If no *COM* port exist, set the number, which is generated after installation of the adaptor. You can find the file *MINISCOPE.INI* in the directory "C:\Program Files\EsrApplications\MiniscopeControl". As a text editor the program *Editor* from the *Accessories* of *Windows* (*Notepad.exe*) can be used.

3.3. Deinstallation of the software

For deinstalling the software you have to select the entry *Settings>Control Panel* in the start-menu. After that start the software-dialogue by double clicking on icon *Add/Remove Programs*. Select *Miniscope_Control_Treatment* in the dialogue and press *Add/Remove* (*Windows98*) or *Remove* (*Windows2000 / Windows XP*).

4. Starting the Spectrometer

The file "MINISCOPE32.EXE" controls the ESR spectrometer *MiniScope*. The control software uses the operating system Windows95/98/2000/XP and calling up certain operations happens in the common manner of Windows. The control software can be started by double clicking the item *Miniscope Control 6.51* in the group *Start\Programs\EsrApplications* or the icon on desktop. Before starting the software the spectrometer has to be switched on.

Sequence of switching on:

- (1) Switch on the PC.
- (2) Switch on the ESR spectrometer MiniScope.
- (3) Start the program *Miniscope Control 6.51*.
- (4) Modify the parameters, if necessary.
- (5) Transmit the parameters.
- (6) Start the automatic tuning.

The transmission of the parameters and the MW adjust have to be carried out every time you switch on the spectrometer. In this way the device is being initialised and executes a first automatic tuning.

5. Miniscope Control

5.1. Contents of the window

After starting the program a window appears (Figure 1).

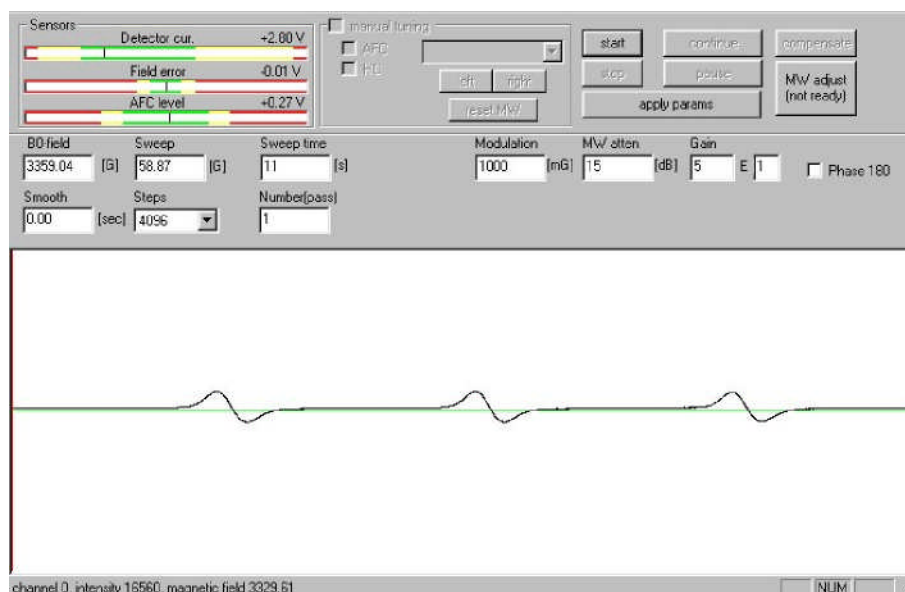


Figure 1

On the left side at the top you see three indicators. The indicators displays the state of the device.

A field to control the tuning is located on the right side of the indicators. If the control box *manual tuning* is inactivated, you have to work using the automatic tuning. *MW adjust* is enabled. Otherwise the tuning has to be done manually using the control elements in the field below the control box. In this case *MW adjust* is disabled.

On the right side at the top of the window you find the switches for controlling the measurement, transmitting the parameters and starting the automatic tuning.

Below you see the fields for modifying the parameters of the *MiniScope*. After starting the program they indicate the parameters being preadjusted in the file MINISCOPE.INI. Below this the measurement is displayed.

5.2. Parameters

The parameters magnetic field, field sweep, sweep time, modulation amplitude, microwave power, gain, phase, filter coefficient, number of data points and number of accumulations can be adjusted.

5.2.1. Magnetic field

The *B0-Field* characterises the B0 value. It has to be entered in Gauss (G) and is allowed to be maximum 4000 G using a scan range (sweep) of 1000 G. In the case of applying a scan range (sweep) of 0 G the maximum *B0-Field* is 4500 G.

The maximum values to be entered are 6000 G as *B0-Field* and 5500 G as *Sweep*. These values are exclusively allowed for devices being equipped with a water-cooled magnet. In all other cases *B0-Field* and *Sweep* have to be entered in a way that the magnetic field is not exceeding a magnetic field of 4500 G and dropping below 500 G during the scan. The magnetic field changes from [*B0-Field* - *Sweep*/2] to [*B0-Field* + *sweep*/2] during the scan.

5.2.2. Sweep time

The *Sweep time* characterises that period of time in seconds needed for one scan.

B0-field	Sweep	Sweep time
3359.04 [G]	58.87 [G]	11 [s]

Figure 2

5.2.3. Modulation amplitude

The modulation amplitude (*Modulation*) has to be entered in mG and can have a maximum of 7000 mG.

5.2.4. Microwave power

The microwave power is characterised as *MW atten* and has to be entered as attenuation in dB. 0 dB corresponds to 100 mW.

The following expression is valid:
$$\text{Attenuation[dB]} = 10 \cdot \log_{10} \left(\frac{(100\text{mW})}{(\text{Power[mW]})} \right)$$

5.2.5. Gain

The amplification of the recorded signal has to be set using the parameter *Gain*. The Gain has to be given in exponential format. It results in the following way: $\text{Gain} = \text{value} \cdot 10^{\text{order}}$. As *Value* (number in front of the *E*) integers between 1 and 9 and as *Order* (number after the *E*) integers between 0 and 2 can be entered.

5.2.6. Phase

The amplifier works according to the principle of phase sensitive rectification. For *Signal Phase* the values 0 and 180 degrees can be set. Switching from 0 to 180 degrees or vice versa allows to invert the measurement signal.



Figure 3

5.2.7. Smooth

Smooth characterises the strength of the low pass filter in seconds. The value 0 inactivates the filter. The hardware of the spectrometer includes a filtering with 0.1 seconds.

5.2.8. Steps

Steps characterises the number of data points of a spectrum. The data acquisition works always with 4096 data points.

5.2.9. Accumulations

Number means the number of repetitions of spectrum registration to obtain an accumulated result.

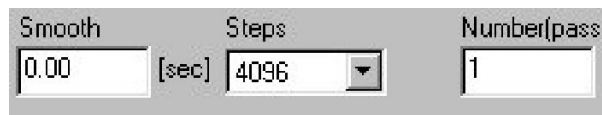


Figure 4

5.3. Parameter adjustment

You can change between the different fields using the mouse or the TAB key. The corresponding parameters can be changed using the keys.

By operating the switch *apply params* the parameters are transmitted to the spectrometer. If the microwave power was changed you have to start a new tuning of the microwave bridge (5.5.Tuning of the microwave bridge).

5.4. Indicators

Detector cur. displays the diode current. The pointer should be in the green or yellow area. *Field error* indicates the deviation of the field value from its nominal value. The position of the pointer depends on the value of sweep. *AFC level* displays the control deviation of the automatic frequency control of the microwave frequency. The pointer has to be in the green area.

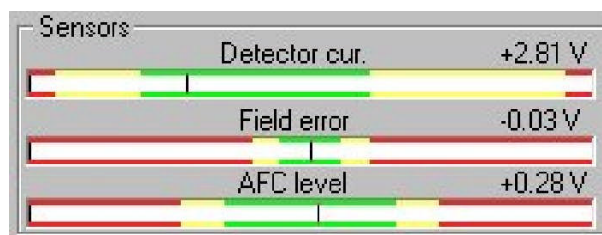


Figure 5

5.5. Tuning of the microwave bridge

The microwave bridge can be tuned automatically or manually.

For working with the automatic tuning the control box *manual tuning* has to be inactivated. After changing to automatic operation the green LED at the front of the device stays in the "off" mode. *MW adjust* is getting enabled and displays "no information". An automatic tuning has to be performed.

In the case the microwave bridge shall be tuned manually the control box *manual tuning* has to be activated. If the operation is changed to the manual mode the green LED is switched off. *MW adjust* is getting disabled and displays "no information". A manual tuning has to be performed.

The tuning of the microwave consists of:

- (1) Frequency tuning
- (2) Coupling
- (3) Phase tuning

Before the start of tuning the sample has to be placed into the *MiniScope*.

5.5.1. Automatic Tuning

An automatic tuning has to be performed in the following cases:

- (1) after the transmission of the parameters after switching on the *MiniScope*
- (2) after a parameter transmission changing the attenuation of the microwave power
- (3) after each sample exchange
- (4) after each change of the operation mode to automatic tuning

For execution of an automatic tuning the switch *MW adjust* has to be operated. The LED is switched of and the switch displays "no information". The advance of automatic tuning is to be readable on the switch *MW adjust*. The changes of the state of the device during the automatic tuning can be followed watching the indicators. The end of the automatic tuning is indicated by the LED shining. The switch *MW adjust* displays "ready".

The automatic tuning requires a protection tube or a fixed temperature dewar being present!

The missing of a protection tube or a fixed temperature dewar leads to a permanent operation of the engine for adjustment and might result in its damage.

After starting of an automatic tuning you have not to press on switch *MW adjust* until the switch *MW adjust* displays "ready" and the LED is shining.

If the automatic tuning is not ready after 4 minutes activate the control box *manual tuning* and press the switch *reset MW*. After that inactivate the control box *manual tuning* and start a new automatic tuning.

5.5.2. Manual Tuning

Manual tuning is required, if measurements shall be executed using a fixed temperature dewar or if measurements are performed using a high microwave power.

In the case you are using a fixed temperature dewar the manual tuning serves for the control and the correction of the coupling and the phase tuning. Regarding measurements using high microwave power the manual tuning serves for the control and correction of the phase tuning.

The frequency tuning has to be executed by the operator in the mode automatic tuning.

The manual tuning of the microwave has to be performed in the following way:

- (1) Execution of an automatic tuning:
 Inactivation of the control box *manual tuning*.
 Operation of the switch *MW adjust*.
 End of the automatic tuning is indicated by the shining of the green LED. The switch *MW adjust* displays "ready".
 If the automatic tuning was successful go on with **(3)**.
 If the automatic tuning is not finished after maximum 4 minutes go on with **(2)**.
- (2) Reset of the microwave tuning:
 Activation of the control box *manual tuning*
 Operation of the switch *reset MW*
 and start again with **(1)**.
- (3) Switch to the manual tuning mode:
 Activation of the control box *manual tuning*. All operation elements for the manual tuning are enabled. The control boxes *AFC* and *HC* (homodyn channel corresponds to reference arm) are not active. The sensor value of the *AFC level* is about 0 V.

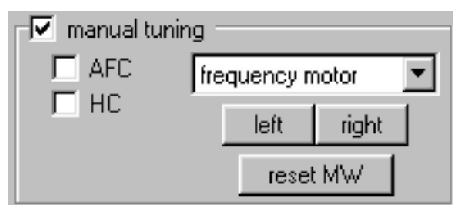


Figure 6

- (4) Coupling:
 Activate control box *AFC*. The indicator value of the *AFC level* stays at about 0 V. The pointer shall be at least in the green area.
 Choose *Couple motor*. By clicking on the switches *left* and/or *right* the coupling is changed. The coupling has to be changed until the indicator value of *Detector cur* reaches a minimum.
- (5) Phase tuning:
 Activate control box *HC*. Choose *Phase motor*. By clicking on the switches *left* and/or *right* the phase is changed.
 In the case of using high microwave power, change the phase until the indicator value for the *Detector cur* reaches a minimum.
 If you work with small microwave power, the changes of the indicator value *Detector cur* will not be visible. In this case after every change of the phase the indicator value *AFC level* is compared between active *HC* and inactive *HC*. The phase tuning is finished, if both values are equal.
- (6) The manual tuning is finished.

5.6. Recording spectra

If the parameters have been transmitted and the tuning of the microwave bridge has been executed successfully the measurement can be started.

For starting the recording of a spectrum the switch *start* has to be operated. After a short delay the recording starts. The previous measurement will be superscribed. If the previously recorded spectrum shall be kept, save it before you start the new recording.

The sweep can be stopped using *pause*. The magnetic field stops at the current value. The recording of the spectrum continues. With *Continue* the field sweep pursues.

If *stop* is pushed sweep and recording of the spectrum stop. Then you can just start once again using *start*.

5.7. Menus

As mentioned above the work with the Pull Down-Menus follows the general habit of the Windows operating system. The description of the single items in the menu is given only concerning aspects required for the operating of the spectrometer.

5.7.1. File

5.7.1.1. New

To cancel the spectrum the menu item *New* from the menu *File* has to be selected.

5.7.1.2. Open

To load a saved spectrum the menu item *Open* from the menu *File* has to be selected. To display the spectrum no new window will be opened. The parameter will be transferred to the menu *Registration parameters* but not automatically transmitted to the *MiniScope*.

5.7.1.3. Save

If *Save* is selected for the first time after starting the program the Save As-Dialogue will be opened. After input of a name and confirming with *Save* the current spectrum will be saved. The name is readable in the title of window.

Every following saving of spectra with *Save* uses this name and overwrites the old spectrum with the same name without warning. A new name can be chosen by using *Save As..*

5.7.1.4. Save As..

If a spectrum is to save with a new name (not with the name of the previous saved spectrum) *Save As..* has to be used.

5.7.2. View

5.7.2.1. Spectrum line params

Selecting the menu item *Spectrum line params* of the menu *View* opens the window *Spectrum line parameters*, which displays the features of the selected (displayed) partial spectrum (Figure 7).

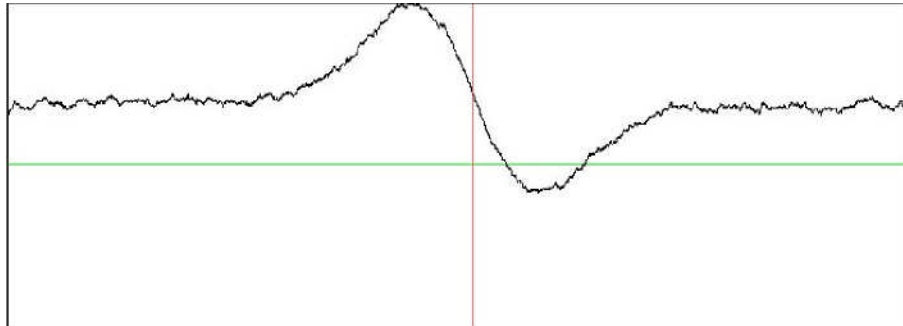


Figure 7

The program searches for a minimum and maximum in the displayed partial spectrum (5.8. Cursor), which are considered to be the minimum and maximum of the respective ESR line.

- *Width* is the difference between the field values of minimum and maximum.
- *H0* is the field value of the middle between minimum and maximum.
- *Intensity* is the difference between the intensities of minimum and maximum.

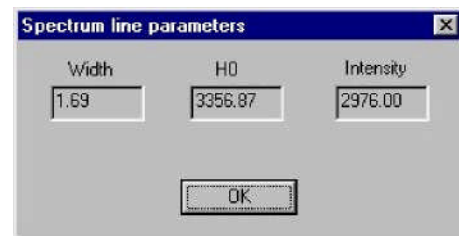


Figure 8

5.7.2.2. Stretch vertically

Activating the menu item *Vert. stretch* in the menu *View* causes the automatic scaling of the Y-axis. Minimum and maximum of the Y-axis will be determined by the minimum and maximum of the spectrum.

5.7.2.3. Cancel v. stretch

Activating the menu item *cancel v. stretch* in the menu *View* undoes the function *stretch vertically*. The Y-axis will be scaled again from 0 to 32760.

5.7.2.4. Shrink to window

By using the cursor (5.8.Cursor) a part of the spectrum can be displayed. Selection of the menu item *Shrink to window* in the menu *View* shows the complete spectrum again.

5.7.2.5. Status Bar

If *Status Bar* is activated, below the spectrum you can see information about the current cursor position.

- *Channel* indicates the index of the currently measured value. The lowest possible value is 0. The maximum value is maximum number of *Steps*-1 (4095).
- *Intensity* indicates the signal intensity at the current position of the cursor.
- *Magnetic Field* is the value of the magnetic field at the current position of the cursor.

5.7.3. Batch

The control program of the *MiniScope* allows the user to perform semi-automatic measurements (in preparation). For that purpose batch programs could be established using any ASCII editor, which can be started using the menu item *Run* in the menu *Batch*. A file dialogue will appear and on using it the desired command-file can be selected. The used commands in the command file must follow a fixed syntax and the file name should have the extension ".cmd".

5.8. Cursor

In order to assess the spectra a cursor is available. A mouse click will set the cursor at the desired position.

The values of the current position of the cursor can be read in the lower left corner of the window.

If the cursor is moved keeping the mouse button pressed that part of the spectrum will be displayed which is in between the original cursor position and the new position. In order to unzoom and to return to the previous view the menu item *Shrink to window* in the menu *View* should be activated.